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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/076,099	02/15/2002	Wayne L. Johnson	P 273243 PC0033A Reg	8536

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EXAMINER	
MCDONALD, RODNEY GLENN	

ART UNIT	PAPER NUMBER
1753	

DATE MAILED: 08/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/076,099	JOHNSON ET AL.	
	Examiner	Art Unit	
	Rodney G. McDonald	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 May 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-18* is/are allowed.

6)☒ Claim(s) *19 and 20* is/are rejected.

7)☒ Claim(s) *21-27* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

S.D.O

DETAILED ACTION

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. (U.S. Pat. 4,579,623) in view of Otsubo et al. (U.S. Pat. 4,808,258).

Regarding claim 19, Suzuki et al. teach a chamber 6 enclosing a plasma region. A gas injection assembly 7 proximate the plasma region. The gas injection assembly is configured to inject a first process gas 9a during a first time and a second process gas 9b at a second time. An RF power source 15 is configured to generate the plasma. A support member 14 is configured to support a substrate 10 in communication with the plasma region. A vacuum pump (not shown) evacuates the chamber as shown by the arrow. Controller 18 controls the gas flows. (See Fig. 10; Column 7 lines 3-55)

The differences between Suzuki et al. and the present claims is that the electromagnetic field having an energy level, which varies cyclically between at least two values each sufficient to maintain the plasma is not discussed and the dc self bias is not discussed.

Otsubo et al. teach supplying a gas to produce a plasma for etching an aluminum film. (Column 3 lines 12-24) The plasma processing method uses amplitude modulated high frequency voltage. ***(Compare to providing an RF electromagnetic field to the chamber)*** In this method, a gas pressure is made higher as compared with the conventional plasma processing method. Further, a high-frequency voltage V_2 lower than the conventional voltage V_1 (shown in FIG. 2) is applied between electrodes for a period t_1, as shown in FIG. 3. ***(Compare to providing the electromagnetic field at two values. This representing the first)*** Since the gas pressure is high, the ion energy at the period t_1 is low, but the discharge current is increased at this period. Accordingly, the energy of an electron flowing from each electrode to a plasma is lowered, but the number of such electrons is increased. Thus, the production of a radical, which contributes to etching, is also increased. ***(Compare to performing a different treatment process)*** (Column 3 lines 47-61)

At a period t_2, a high-frequency voltage V_3 higher than the conventional voltage V_1 is applied between the electrodes, under a high gas pressure. ***(Compare to providing the electromagnetic field at two values. This representing a second value)*** Thus, ion energy necessary for removing the aluminum oxide film and for forming the sidewall is obtained. ***(Compare to performing a different treatment***

process) The ion energy distribution in the above case is schematically shown in FIG. 4. (Column 3 lines 62-68)

The high frequency voltage is at 13.56 MHz. (Column 6 line 55) ***(Compare to providing an RF electromagnetic field to the chamber)***

The amount and energy of the ion can be changed by changing the ratio t_1/t_2 and voltage V_3. ***(Compare to Applicant's required varying of the energy level during different repetition periods during respectively different time intervals.)***

In Fig. 8 a processing chamber is shown with a gas inlet 11 and gas outlet 12. (Column 6 lines 43-45) The gas outlet inherently requires a pump to maintain vacuum for plasma processing. This is also recognized in other embodiments, which require an evacuating means (not shown). (Column 8 line 68; Column 9 line 1) An RF power source is provided in the form of a standard signal generator 21 at a frequency of 13.56 MHz. (Column 6 lines 55-59) The signal generator produces an electromagnetic field which creates a plasma the field has an energy level that varies cyclically between at least two values as seen in Figure 3. The values are V_2 and V_3. (See Fig. 3)

With regard to the DC self-bias, since RF bias is applied to the substrate the voltage produces a dc self bias which varies between two values V_1 and V_2. (See voltages discussed above)

The motivation for utilizing an electromagnetic field having an energy level, which varies cyclically between at least two values each sufficient to maintain the plasma is that it allows for adjustment of the kind of ion and radical formed in the plasma. (Column 1 lines 66-68)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Suzuki et al. by utilizing an electromagnetic field having an energy level, which varies cyclically between at least two values each sufficient to maintain the plasma as taught by Otsubo et al. because it allows for adjustment of the kind of ion and radical formed in the plasma.

Allowable Subject Matter

Claims 1-18 are allowed.

Claims 21-27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Claims 1-18 are allowable over the prior art of record because the prior art of record does not teach the claimed subject matter including introducing a first process gas into the reactor chamber during a first time period and introducing a second process gas having a different composition than the first process gas during a second time period which the first time period and causing the electromagnetic field to have an energy level which varies cyclically between at least two values each sufficient to maintain the plasma, such that each energy level value is associated with performance of a respectively different treatment process on the substrate.

Claims 21-27 are indicated as being allowable because the prior art of record does not teach the gas injection assembly comprising a gas injection plate provided with

a plurality of gas injection nozzles; a plurality of gas injection valves, each configured to supply at least one of the first or second process gases to at least one respective one of the nozzles; and a plurality of valve controllers coupled to the plurality of gas injection valves to cause the first or second gas to be supplied to each of the nozzles in an intermittent manner.

Response to Arguments

Applicant's arguments filed 5-27-05 have been fully considered.

Applicant has argued that the Ohara et al. reference previously applied is not applicable as prior art since the effective priority date of Applicant's application is prior to the U.S. filing date of Ohara et al. The Examiner agrees with this statement. However a new reference has been cited to Suzuki et al. has been cited to show the features of the claims. The Examiner awaits Applicant's response regarding the new rejection based on Suzuki et al.

This action will be made NON-Final.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
August 17, 2005